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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/590,105	06/21/2007	Iwamura Eiji	14434.112USWO	5113
52835	7590	12/21/2010	EXAMINER	
HAMRE, SCHUMANN, MUELLER & LARSON, P.C.			HORNING, JOEL G	
P.O. BOX 2902			ART UNIT	PAPER NUMBER
MINNEAPOLIS, MN 55402-0902			1712	
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

## Office Action Summary

Application No.

10/590,105

Applicant(s)

EIJI, IWAMURA

Examiner

JOEL G. HORNING

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 11 October 2010.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) 1-12 and 26-30 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 13-25 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date 8-22-08; 11-21-08
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Information Disclosure Statement*

1. The information disclosure statement filed 08-22-06 and 11-21-06 fail to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each cited foreign patent document; each non-patent literature publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered.

### *Election/Restrictions*

2. Claims 1-12 and 26-30 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on October 11<sup>th</sup>, 2010. Claims 13-25 are currently undergoing prosecution.

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. **Claims 13-21, 23 and 24** are rejected under 35 U.S.C. 102(b) as being anticipated by Iwamura (US 20020061397) as evidenced by applicant's specification.

Iwamura teaches a method for forming an amorphous carbon thin film layer on a substrate. This amorphous carbon layer is supplied with energy by irradiating it

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with an electron beam (**claim 17**) in order to form onion-like carbon structures in the amorphous carbon [0021]. These onion-like structures are also known as onion-like graphite, since they are made from graphite [0005]. Iwamura does not teach the morphology of its amorphous carbon film, so it does not teach that it has columnar first phases and second phases intervening between them.

According to applicant's specification, in order to form an amorphous carbon two phase structure with the first structure being columnar and the second phase surrounding it like a network, what is preferably used (though applicant discloses it will form outside these ranges) is a sputtering process where at least one of the following conditions is fulfilled: the substrate is preferably less than 500°C and the chamber pressure is preferably 10mTorr or more (page 10, lines 2-27).

Iwamura further teaches that the amorphous carbon film is grown by a vapor phase process (**claim 14**), specifically a sputtering method [0041], where the pressure ranges used overlaps with applicant's described range and the substrate is not taught to be heated, so it is clearly envisaged to be at room temperature and certainly below 500°C. This even more clearly is the case since applicant teaches that if higher temperatures are used, it is difficult to make amorphous carbon films (page 10, lines 9-12) (**claim 15**) and Iwamura is producing amorphous carbon.

Thus, it is clearly envisaged manner and conditions taught by Iwamura for forming an amorphous film are what applicant discloses will form the claimed two phase film structure with the first phase being columnar and the second phase being

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a network between the first phases (**claim 23**) and all limitations of the claim are clearly envisaged to be present in the taught process of Iwamura (**claim 13**).

4. Regarding **claim 16**, Iwamura teaches depositing nitrogen along with the carbon, and since the process is a vapor phase process, the nitrogen must come from a nitrogen gas in the processing gas atmosphere [0027].
5. Regarding **claims 18 and 21**, Iwamura teaches using acceleration voltages of 200V or less [0042], which would produce an electron beam of, for example, 200eV or less, far below the more than 100keV applicant describes is required for the graphite structures not to preferentially grow in the second phase (page 12, lines 15-19). Thus it is clearly envisaged that in the process of Iwamura, the graphite will preferentially grow in the second phase and thus have a higher volumetric concentration in the second phase.
6. Regarding **claim 19**, according to applicant, when the film is formed as previously described by applicant and performed by Iwamura, the second phase will normally have a lower density than the first phase (page 11, lines 19-22). Thus it is clearly envisaged that the claimed result of a lower density in the second phase than in the first phase inherently flows from the process of Iwamura. Additionally, as discussed above, since the graphite preferentially grows in the second phase, it is apparent that it is easier to change the structure of the second phase than the first phase, otherwise the growth would not be preferential.
7. Regarding **claim 20**, Iwamura teaches that the practitioner will choose how much of the film to convert to the graphite phase, particularly teaching making 50% *or more*

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of the film structure into the graphite phase [0028]. According to applicant, the reversal in density so that the second phase is more dense than the first is a result that flows from converting enough of the film into the graphite material with, as previously discussed, the second phase being preferentially converted (page 13, lines 6-11).

Thus, since it is taught to convert 50% *or more* of the film into the graphite phase, it is readily apparent that starting at some minimum percentage of conversion in the process taught by Iwamura the second phase density will start being higher than the first phase and thus this claimed feature will result.

When a reference discloses the limitations of a claim except for a property, and the Examiner cannot determine if the reference inherently possesses that property (in this case, that the density of the second phase becomes greater than the first when the film is converted up to the degrees taught by Iwamura), the burden is shifted to Applicant(s). In re Fitzgerald, USPQ 594 and MPEP §2112 (**claim 20**).

8. Regarding **claim 24**, Iwamura teaches only exposing a region to the electron beam, which results in only converting the exposed area to the graphite phase [0005].

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
  2. Ascertaining the differences between the prior art and the claims at issue.
  3. Resolving the level of ordinary skill in the pertinent art.
  4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
9. **Claims 22, 24 and 25** are rejected under 35 U.S.C. 103(a) as being unpatentable over Iwamura (US 20020061397) in view of Tanaka (US 6251522).
10. Regarding **claim 22**, Iwamura teaches using an "appropriate energy and flux" of the electron beam in order to create the graphite structures [0021], but does not teach what the appropriate flux would be.

However, Tanaka is also directed towards a method of creating graphite structures in amorphous carbon films by irradiating the amorphous carbon layer with a high energy beam (col 2, lines 50-61). It further teaches that an appropriate flux for the electron beam for that purpose includes  $10^{19} \text{e}^1 \text{cm}^{-2} \text{s}^{-1}$ , (col 6, lines 14-16) which overlaps with applicant's claimed range.

MPEP 2144.05 states: "In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists."

11. Regarding **claims 24 and 25**, though Iwamura teaches only exposing a portion of the amorphous film to the electron beam, it teaches using the focused beam of an transmission electron microscope to do so [0021]. It does not teach using a mask to limit the exposure to the beam.

However, Tanaka also teaches that it is desirable to control the location of the graphite structures so as to form a pattern (col 5, lines 15-21) and that one way to control exposure of the substrate surface to an energy beam is by placing a mask on the amorphous carbon surface and irradiating the surface through that so only the exposed areas are irradiated by the beam (col 4, lines 50-65).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to pattern the regions of the amorphous carbon film so that only certain regions have been converted to the graphite phase since it was known to be desirable to produce patterns of regions that have been converted to the graphite structure and to do so by the method taught by Iwamura of exposing only the regions that are desired to be converted to the graphite phase to the electron beam (**claim 24**) and further to limit exposure to the beam by applying a mask to the surface of the graphite substrate since that was a known method to limit exposure of an amorphous carbon surface to energy beams which would produce no more than predictable results (**claim 25**).

12. **Claims 13-21, 23 and 24** are alternately rejected under 35 U.S.C. 103(a) as being unpatentable over Iwamura (US 20020061397) as discussed previously in view of '632 (JP-2004-261632, from the English machine translation).

As discussed previously, Iwamura teaches the claimed processing steps and growing the amorphous carbon film by a vapor phase process, specifically a sputtering method [0041]. Iwamura further teaches that the graphite structures it produces in an amorphous carbon film are very useful for the trapping of hydrogen



atoms [0005], but does not teach if the resulting morphology of its amorphous carbon film gas has columnar first phases and second phases intervening between them.

'632 is also directed towards the formation of amorphous carbon films used for trapping hydrogen [0001]. It teaches that a normal structure for the amorphous carbon film is as seen in figure 1, where there is a columnar first phase **2** and a network-like second phase **4** that surrounds the first phase [0014] (**claim 23**). This structure is particularly desirable for the formation of hydrogen trapping devices because the second phase has a lower density than the first phase (**claim 19**) and so the hydrogen can more easily be moved into the hydrogen storage medium thus making the hydrogen absorption occur more rapidly [0021-0023].

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to utilize the amorphous carbon structure of '632 in the process of Iwamura in order to increase the hydrogen trapping speed of the device (**claim 13**).

'632 further teaches that this structure is formed by a vapor deposition method (**claim 14**) where pressures and temperatures are the same as claimed by applicant (**claim 15**)[0027-0029].

**Claims 16-18, 20, 21 and 24** are rejected again for the same reasons they were previously, but now in view of '632.

13. **Claims 22, 24 and 25** are alternately rejected under 35 U.S.C. 103(a) as being unpatentable over Iwamura (US 20020061397) as discussed previously in view of

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'632 (JP-2004-261632, from the English machine translation) as applied to claim 13 further in view of Tanaka (US 6251522).

These claims are rejected again for the same reasons they were previously, but now in view of '632.

***Conclusion***

14. No current claims are allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOEL G. HORNING whose telephone number is (571) 270-5357. The examiner can normally be reached on M-F 9-5pm with alternating Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael B. Cleveland can be reached on (571)272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/J. G. H./  
Examiner, Art Unit 1712

/David Turocy/  
Primary Examiner, Art Unit 1715